



DATA USERS' NOTE

NSSDC 70-09

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APOLLO 12 LUNAR PHOTOGRAPHY

(NSSDC ID NO. 69-099A-01)

JULY 1970



NATIONAL SPACE SCIENCE DATA CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

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July 1970

FOREWORD

The purposes of this Data Users' Note are to announce the availability of the complete set of Apollo 12 pictorial data and to aid an investigator in the selection of Apollo 12 photographs for study. In addition, this Note can provide guidance in the interpretation of the photographs. As background information, the Note includes brief descriptions of the Apollo 12 mission objectives, photographic equipment, and photographic coverage and quality. The National Space Science Data Center (NSSDC) can provide all forms of photographs described in the section on Format of Available Data.

NSSDC will supply, as resources permit, limited quantities of photographs without charge where they are to be used, first, for specific scientific studies and, second, for college-level science courses. All requesters should refer to the section on Ordering Procedures for specific ordering instructions. Scientists conducting an investigation that requires photographic data should inform NSSDC of their needs and should identify the nature of their study, their affiliation with a scientific organization, university, or company, and any government contracts they may have for performing the investigation. The Data Center seeks to keep informed of the results of any scientific investigations performed with the use of Apollo photographs. We therefore request that scientists submit reprints of any published papers to the Data Center so that the results of their studies can be made known to other users. It is also requested that in such papers NSSDC be acknowledged as the source of photographic data.

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APOLLO 12 LUNAR PHOTOGRAPHY

INTRODUCTION

Apollo 12 (1969-099A) was launched from Cape Kennedy, Florida, on November 14, 1969, on a 10-day lunar landing mission. The spacecraft attained a near-circular orbit with an apolune of 66 nautical miles and a perilune of 54 nautical miles. Photography during the mission was accomplished from the Apollo 12 command module (CM), which spent 89 hours in lunar orbit; from the lunar module (LM), which landed successfully at 2.94° south latitude and 23.45° west longitude in the southeastern region of Oceanus Procellarum; and by the Apollo 12 astronauts during extravehicular activities (EVA) on the lunar surface. The command module and crew returned to earth on November 24, 1969.

The purposes of this second Apollo lunar landing mission were: (1) to obtain geologic samples (from an area different from that of the Apollo 11 mission); (2) to land within 200 meters of Surveyor 3 using more accurate trajectory data than the previous mission in order to examine the spacecraft and bring back the television camera, surface sampler, and other parts of Surveyor 3; and (3) to implant an Apollo Lunar Surface Experiments Package (ALSEP) that included a lunar surface magnetometer, a passive seismograph, a solar wind spectrometer, and a suprathreshold ion detector.

PHOTOGRAPHIC OBJECTIVES

Apollo 12 represented man's second opportunity to directly observe scientific phenomena on the lunar surface. Both the surface and orbital photography of the mission served not only to document man's second lunar landing and the extravehicular activities of the astronauts, but also to identify scientific areas and experiments for study in future missions.

The photographic equipment and materials carried by Apollo 12 were designed specifically: (1) to photograph "targets of opportunity," i.e., scientifically interesting sites and potential Apollo landing sites as time and circumstances permitted; (2) to obtain photographs of the lunar module and lunar surface activities after LM landing; (3) to obtain multispectral, vertical, and oblique stereo strips of nearside and farside regions of scientific interest; (4) to record mission operational activities; (5) to obtain documentation for subsequent landing crew training purposes; and (6) to obtain photographic information to document the geologic samples.

PHOTOGRAPHIC EQUIPMENT

Cameras

The camera equipment carried by Apollo 12 consisted of: one 70-mm Hasselblad EL camera; two Hasselblad data cameras; two 16-mm Maurer data

acquisition cameras; one 35-mm lunar surface closeup stereoscopic camera; and a four-camera, multispectral S-158 experiment.

70-mm Hasselblad EL Camera. This camera, which was carried aboard the command module, featured a motor-drive mechanism, powered by two nickel-cadmium batteries, that advanced the film and cocked the shutter whenever the camera was activated. The settings and ranges for equipment on this camera were:

Lens Focal Length:	80 mm	250 mm	500 mm
Focus:	3 ft to infinity	8.5 ft to infinity	28 ft to infinity
Aperture:	f/2.8 to f/22	f/5.6 to f/45	f/8 to f/64
Shutter Speed:	1 sec to 1/500 sec	1 sec to 1/500 sec	1 sec to 1/500 sec
Field of View	37.9° side, 51.8° diagonal	12.5° side, 17.6° diagonal	6.2° side, 8.8° diagonal
Film Magazine Capacity:	190 frames B&W, thin base 160 frames color, thin base 100 frames, standard base		

70-mm Hasselblad Data Cameras. The two electrically powered data cameras that were carried on the lunar module featured semiautomatic operation. They used a 60-mm Biogon lens exclusively. The operating sequence was initiated by squeezing a trigger mounted on the camera handle. A 1-centimeter reseau grid was set in front of the image plane to provide photogrammetric information in the analysis of the photography. The cameras were bracket-mounted on the front of the LM astronauts' EVA suits. The settings and ranges for equipment on these cameras were:

Lens Focal Length:	60-mm Biogon
Focus:	5, 15, and 74 ft
Aperture:	f/5.6 to f/22
Shutter Speed:	1 sec to 1/500 sec
Field of View:	49.2° side, 66° diagonal
Film Magazine Capacity:	190 frames B&W, thin base 160 frames color, thin base

16-mm Maurer Data Acquisition Cameras. Apollo 12 carried two Maurer data acquisition cameras (DAC), one in the command module and one in the lunar module. The cameras were used primarily to record engineering data and for continuous-sequence terrain photography. The CM camera had lenses of 5-, 10-, 18-, and 75-mm focal lengths; the LM camera was fitted with a 10-mm wide-angle lens. Accessories included a right-angle mirror, a power cable, a sextant adapter, a right-angle adapter, and a CM boresight window bracket.

The Maurer cameras weighed 2.8 pounds each, with a 130-foot film magazine attached. They had frame rates of 1, 6, and 12 fps automatic and 24 fps semiautomatic at all lens focal lengths, and shutter speeds of 1/60, 1/125, 1/250, 1/500, and 1/1000 second, also at all lens focal lengths. Other

settings and ranges for equipment on the cameras were:

Lens Focal Length:	5 mm	10 mm	18 mm	75 mm
Focus:	fixed from front of lens to infinity	6 in. to infinity	12 in. to infinity	42 in. to infinity
Aperture:	f/2.0 to f/16	T/1.8 to T/22	T/2 to T/22	f/2.5 to f/32
Field of View:	117.5° hor. x 80.2° vert.; 160° diag.	54.9° hor. x 41.1° vert.; 65.2° diag.	32.3° hor. x 23.5° vert.; 39.2° diag.	7.9° hor. x 5.7° vert.; 10° diag.

Film Magazine Capacity: 140 feet, thin base

35-mm Lunar Surface Closeup Stereoscopic Camera. This camera, which was carried on the lunar module's Modular Equipment Storage Assembly (MESA), was designed for the highest possible resolution for a stereo pair area with a flash illumination and fixed distance. Photography was accomplished by holding the camera on a walking stick against the object to be photographed. The camera was powered by four nickel-cadmium batteries that operated the motor drive mechanism and an electronic flash strobe light. The capabilities, settings, and ranges for equipment on this camera were:

Area Photographed:	72 mm x 82.8 mm
Camera Lenses:	diffraction limited to 46.12 mm at f/17 using Kodak M-39 copy lenses focused for object distance of 184.5 mm
Focus:	fixed range
Aperture:	f/22.6 fixed
Film:	30-ft S0-368 - 112 stereo pairs
Surface Particle Identification:	as low as .004 in.
Resolution:	approximately 40 microns
Magnification:	0.33 times
Base-Height Ratio:	0.16 for stereoscopic photos
Stereo Angle:	9° convergent
Cycling Time:	10 sec
Object Plane Coverage:	9 sq in.

Four-Camera, Lunar Multispectral S-158 Experiment. The lunar multispectral camera (LMC) experiment used four Hasselblad EL cameras. The objectives of the experiment were: (1) to photograph lunar surface color variations for geologic mapping, (2) to correlate photographs with spectral reflectance of returned samples for composition determination, (3) to photograph potential lunar landing sites, and (4) to make comparative studies of lunar reflectance variation and wavelengths. (A similar experiment was flown as the S0-65 earth multispectral photography experiment on Apollo 9.)

The four cameras used had the same parameters, settings, and ranges as the Hasselblad EL camera with the 80-mm lens. The cameras were mounted in a ring bracket perpendicular to the command module hatch window + 5° from nadir, such that they were aimed and operated simultaneously. Camera alignment was 57.5° pitched up from the X axis. The shutters were automatically tripped by an intervalometer at 20-second intervals to obtain vertical strip photography. The film/filter combinations for the cameras were:

	<u>Film</u>	<u>Filter</u>
Camera 1	B&W 3401	Photar 47B (blue)
Camera 2	B&W 3401	Photar 29 (red)
Camera 3	B&W 3401	Wratten 58 (green)
Camera 4	IRBW SO-246	Photar 87C (black)

Films

The films used throughout the mission were as follows.

SO-368 Film (CEX)

Description: Ektachrome MS, color reversal, ASA 64; haze filter required
 Resolution: 80 lines/mm for 1000:1 test object contrast
 Use: terrain and general photography

SO-168 Film (HCEX and CIN)

Description: Ektachrome EF, high-speed color reversal, ASA 160 for surface and interior photography; no filter required; HCEX exposed and developed at ASA 160, and CIN exposed and developed at ASA 1000
 Resolution: 80 lines/mm for 1000:1 test object contrast
 Use: surface and interior photography at low light levels

3400 Film (B&W)

Description: Panatomic-X, black and white, ASA 80
 Resolution: 170 lines/mm for 1000:1 test object contrast
 Use: high-resolution terrain photography

3401 Film (MBW)

Description: Plus-X, medium-speed black and white, ASA 64 (with filter)
 Resolution: 105 lines/mm for 1000:1 test object contrast
 Use: terrain photography (LMC experiment)

SO-267 Film (HBW)

Description: Plus-XX, high-speed black and white thin base film, ASA 278
Use: terrain photography

SO-164 Film (B&W)

Description: medium-speed black and white, AEI of 20
Use: terrain photography

SO-246 Film (IRBW)

Description: infrared black and white thin base film, AEI of 125 (with 89B filter)
Use: terrain photography (LMC experiment)

Accessories

Standard accessories for the Apollo 12 photographic equipment included the following.

- A light meter, used on the command module, was an automatic spot meter with a narrow angle of acceptance (limited to 1°). The scales on the meter were automatically rotated to give the correct aperture and shutter speed settings.
- A right-angle mirror was used on the front of the 16-mm data acquisition cameras (when the 18-mm and 75-mm lenses were used) for bracket-mounted photography.
- A folding ring sight - an optical aiming device - was used on the 70-mm data cameras to correct Newton interference in which light rays interfere in a spherically varying mode.
- A camera bracket pitched 10° from the X axis was used on the 70-mm EL camera with the 500-mm lens.
- A Hasselblad adapter bracket was used to mount the EL camera in the command module rendezvous window. With the 80-mm lens, the camera was aligned along a line pitched up 12° from the X axis; with the 250-mm lens, the camera was aligned along the X axis.
- Camera bracket mounts were used on the front of the LM astronauts' suits to hold the 70-mm data cameras.
- A 108-in. power cable was used in the command module to provide power for the 16-mm Maurer cameras.

- A boresight bracket was used on the CM rendezvous window for the 16-mm Maurer camera.
- A sextant adapter was used with the 16-mm Maurer cameras.
- Three types of filters were used. (1) A haze filter (Photar 2A), which has a cutoff of 3400 Å and less, a transmittance of 100 percent in the visible spectrum, and needs no exposure correction, was used with the SO-368. (2) A red filter (Photar 25A), which has a cutoff of 6000 Å and less, a transmittance of 90 percent for 6500 Å and longer, and an exposure correction of 2.5 stops (needs added exposure), was used with black and white film to reduce atmospheric haze. (3) A polarizing filter was used on the Hasselblad data camera for the photo geology and light polarizing studies.

PHOTOGRAPHIC COVERAGE AND QUALITY

The orbital and surface lunar photographs obtained during the Apollo 12 mission were of good quality, resolution, and contrast. There were 1584 frames of 70-mm photography, 69,519 frames of 16-mm photography, 15 pairs of lunar surface stereoscopic photographs, and 564 frames of photography from the S-158 experiment. Although only three near-vertical stereo strips were obtained, excellent low- and medium-oblique photographs were taken. Photos taken from the lunar module and on the lunar surface during deployment of the ALSEP and the Surveyor 3 area traverse were also of good quality.

Although the Apollo 12 coverage included photographs of the earth, only the lunar photographs are described in this Data Users' Note. For information on the photographs of the earth, please refer to the section on Ordering Procedures.

The photographic coverage of the command and lunar modules is described in map form in the "Apollo Mission 12 Lunar Photography Indexes," which accompanies this Data Users' Note. On the index maps, photographic coverage is depicted on a mercator projection with an approximate scale of 1:7,500,000 at the equator. The index consists of four separate sheets that indicate targets of opportunity shown on 70-mm color and black and white film (sheet 1); targets of opportunity shown on 70-mm black and white film, plus photography from the S-158 experiment (sheet 2); and sequence photography on 16-mm color and black and white film (sheets 3 and 4).

An index of all photography taken during the Apollo 12 mission is contained in "Apollo 12 Photography: 70-mm, 16-mm, and 35-mm Frame Index," which also accompanies this Data Users' Note. For each 70-mm frame, the index presents information on: (1) the focal length of the camera, (2) the photo scale at the principal point of the frame, (3) the selenographic coordinates at the principal point of the frame, (4) the percentage of forward overlap of the frame, (5) the sun angle (medium, low, high), (6) the quality of the photography, (7) the approximate tilt (minimum and maximum) of the camera, and (8) the direction of tilt. A brief description of each frame also appears in the index.

The index to the 16-mm sequence photography includes information concerning the approximate surface coverage of the photographic sequence and a brief description of principal features shown. A "remarks" column is also included to indicate: (1) if the sequence is plotted on the photographic index map and (2) the quality of the photography. In addition, the pictures taken using the lunar surface closeup stereoscopic camera are described.

Also included with this Data Users' Note is the "Apollo 12 70-mm Photographic Catalog," which contains proof prints of the 70-mm photography exposed during the Apollo 12 mission. These prints are sorted by magazine and frame number.

A summary of the photographic coverage for each film magazine is given in the appendixes to this DUN. This summary is ordered by film type and size.

FORMAT OF AVAILABLE DATA

The Apollo 12 films on file at NSSDC include master positive copies of the original 70-mm, 16-mm, and 35-mm films that are stored at the NASA Manned Spacecraft Center (MSC), Houston, Texas. These films were processed by the MSC Photographic Technology Laboratory and constitute the NSSDC master copies. To satisfy requests for photographs, additional (second-generation) working copies have also been prepared. An indication of the standard formats and sizes of Apollo 12 photography available from NSSDC is given below.

70-mm Photography

Reproductions of complete magazines of 70-mm photography can be obtained either (1) as positive or negative film copies on 70-mm black and white roll film or (2) as positive contact black and white paper prints on 70-mm roll paper. Selected frames of 70-mm photography will be processed in limited quantities as 8- x 10-inch black and white paper prints or as contact black and white positive or negative film copies on 4- x 5-inch film sheets. (Color reproductions in the form of contact positive or negative film copies on 4- x 5-inch film sheets or as 8- x 10-inch prints can be obtained for selected frames. However, the color reproductions will be provided only to those persons performing detailed investigations.)

16-mm Photography

The 16-mm sequence films are available as 16-mm positive or negative color film duplicates. For convenience, the individual 16-mm magazines have been spliced together and are available on one reel. It should be pointed out that this photography is suitable only for scientific investigation. These films normally will be provided on a 3-month loan basis, although in special instances arrangements can be made for permanent retention.

35-mm Photography

Reproductions of the 35-mm stereo photography can be obtained as 35-mm color stereo slides in glass mounts.

ORDERING PROCEDURES

When ordering photographic data, please refer to "Apollo Mission 12 Lunar Photography Indexes" and "Apollo 12 Photography: 70-mm, 16-mm, and 35-mm Frame Index" and indicate:

- Apollo mission number,
- complete frame number(s), e.g., AS12-50-7325,
- form and size of reproduction, e.g., 8 x 10" B&W print or 4 x 5" color positive transparency, and
- other identifying information such as crater or feature names.

The Apollo Lunar Photography Order Form enclosed with this Note is provided for the requester's convenience. All parts of the form must be completed to ensure satisfactory request fulfillment. If the photographs are to be used in an ongoing or planned study, this should be indicated in the appropriate place on the form, and some indication of the nature of the study and of whether it is being performed under contract to the government should be given. To assist NSSDC in processing requests for reproductions, please identify all required photography in a single order.

NSSDC will provide reproduction support to individuals and organizations only when the data requested are needed for specific scientific research projects or for use in college-level science courses, in that order. The current policy in satisfying such requests is to furnish limited quantities of reproductions without charge. Nominal charges will be imposed for large orders. When charges are deemed necessary, the requester will be advised of the exact charge and the procedure for making payment before the request is filled. The price list provided on the order form is intended to give the reader an indication of the per item cost of reproductions in the event charges are necessary.

The Apollo 12 pictures may be reviewed at NSSDC. Inquiries about or requests for photographs from U.S. scientists should be addressed to:

National Space Science Data Center
Code 601.4
Goddard Space Flight Center
Greenbelt, Maryland 20771

Telephone: (301) 982-6695

Requests for photographs from researchers outside the U.S.A. should be directed to:

World Data Center A for Rockets and Satellites
Code 601
Goddard Space Flight Center
Greenbelt, Maryland 20771 U.S.A.

The World Data Center A for Rockets and Satellites is now assisting scientists located outside the United States in acquiring space science data held in U.S. national archives. Since January 2, 1969, it has been located contiguous to NSSDC.

Individuals or organizations that wish to obtain Apollo 12 photographic reproductions for purposes other than use in research projects or college-level science courses should address their requests to:

Public Information Division
Code FP
National Aeronautics and Space Administration
Washington, D.C. 20546

Printed materials to satisfy general information requests are also available from this division.

Representative sets of Apollo photographs suitable for framing can be obtained (at cost) as full-color lithographs from:

Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

Requests should specify NASA picture sets as follows.

- NASA Picture Set 1, "Apollo - In the Beginning" (\$1.25)
- NASA Picture Set 2, "Men of Apollo" (\$1.00)
- NASA Picture Set 3, "Eyewitness to Space" (\$2.75)
- NASA Picture Set 4, "First Manned Lunar Landing" (\$1.75)
- NASA Picture Set 5, "Man on the Moon" (\$1.00)

Inquiries or requests regarding pictures of the earth taken during the Apollo missions should be directed to:

Technology Application Center
University of New Mexico
Albuquerque, New Mexico 87106

ACKNOWLEDGMENTS

The Data Center wishes to thank the individuals and organizations responsible for the high-quality photographs and supporting data obtained during the Apollo 12 mission. The mission photography was successfully accomplished by the Apollo 12 crew: Astronauts Charles Conrad, Jr., Richard F. Gordon, Jr., and Alan L. Bean.

Arrangements to have the photographs and data available through NSSDC were made with the assistance of Dr. Richard Allenby, Assistant Director, Lunar Science, Apollo Lunar Exploration Office, NASA Headquarters, and Mr. James Sasser, Chief, Mapping Sciences Laboratory, NASA Manned Spacecraft Center. Copies of the photographs and the supporting documentation were furnished by the MSC Photographic Technology Laboratory and the Mapping Sciences Laboratory, respectively. The lunar index maps were printed by the USAF Aeronautical Chart & Information Center, St. Louis, Missouri, from data provided by the Mapping Sciences Laboratory.

BIBLIOGRAPHY

"Apollo 12 Photography Index, 70 mm and 16 mm," Mapping Sciences Laboratory, Science and Applications Directorate, NASA Manned Spacecraft Center, Houston, Texas, Dec. 22, 1969.

"Final Photographic and TV Operations Plan - Apollo 12," Experiments Section, Mission Operations Branch, Flight Crew Support Division, NASA Manned Spacecraft Center, Houston, Texas, Oct. 20, 1969.

Gold, T., "Apollo 11 Observations of a Remarkable Glazing Phenomenon on the Lunar Surface," Science, 165, No. 3900, pp 1345-1349, Sept. 26, 1969.

"The Role of Optics in the Apollo Program," Optical Spectra, 3, No. 5, Sept.-Oct. 1969.

APPENDIXES

Summary of Apollo 12
Photographic Coverage

APPENDIX A
70-mm Photographic Coverage

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-368 70 mm Color	Q	AS12-50-7325 thru 7459	This magazine contains photographs taken after translunar injection (TLI) with the 80-, 250-, and 500-mm lens. It includes photographs of the earth, craters Petavius-E, Erastosthenes, and Humbolt, and targets of opportunity 3, 4, 5, 10a, 11, 12, 18, 23, 26, 27, 30, 32, 34, and 35.*
	R	AS12-51-7460 thru 7588	These photographs of the lunar surface were taken from the command module at 60 n.m. The 80- and 250-mm lens were used throughout. Most of the photographs cover an area from 35° east to 40° west longitude on the nearside. Targets of opportunity 7, 8, 9, 15, 23, 25, 26, 27, 29, 31, 32, 33, 34, 35, 36, 37, 39, 40, 42, 43, 44, 45, and 47* are also covered.
SO-168 70 mm Color	V	AS12-47-6869 thru 7021	This magazine contains photos taken from the LM in orbit and on the surface of the moon. It includes coverage of the ALSEP deployment and of the area in the vicinity of the LM, exposed with the 60-mm lens.
	Y	AS12-46-6715 thru 6868	This magazine was photographed on the lunar surface with the 60-mm lens. It includes seven panoramas of the traverse and photographs of the Surveyor crater and Surveyor examinations.

*The targets of opportunity are identified in the "Apollo Targets of Opportunity Chart - Apollo 12," published October 23, 1969, by the Aeronautical Chart & Information Center. Copies of this chart are available, on a limited basis, from NSSDC.

APPENDIX A (continued)

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-164 70 mm B&W	S	AS12-52-7589 thru 7762	The Hasselblad EL camera at 60 n.m. was used to photograph these frames. The magazine covers from 130° east to 45° west longitude and 15° north to 50° south latitude. Coverage of Fra Mauro, Copernicus, and Descartes is also included.
	T	AS12-54-7948 thru 8120	This magazine was taken from the command module with the 80-mm lens in a near-vertical stereo mode. It includes Fra Mauro, sites 5 and 7, and targets of opportunity 8, 13, 15, 18, 23, 26, 27, 32, 35, 39, and 48.*
	EE	AS12-55-8121 thru 8297	This magazine contains command module photography from 60 n.m. It includes coverage from 113° east longitude to 5° south latitude and 34° east longitude to 11° south latitude. Shown are craters Kapteyn, Langrenus A, Magellhaens, and La Perruse; targets of opportunity 13 and 53;* and transearth injection (TEI) photos.
SO-267 70 mm B&W	X	AS12-48-7022 thru 7171	This magazine was exposed during and after the second EVA. It includes seven panoramas showing the lunar surface and photographs of the Surveyor 3 spacecraft and the ALSEP equipment.
	Z	AS12-49-7172 thru 7324	This magazine was exposed during the second EVA. It includes seven panoramas of the overall terrain, as well as photographs of geologic tools on the surface, various craters, and the LM.

*The targets of opportunity are identified in the "Apollo Targets of Opportunity Chart - Apollo 12," published October 23, 1969, by the Aeronautical Chart & Information Center. Copies of this chart are available, on a limited basis, from NSSDC.

APPENDIX A (continued)

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
Panatomic-X 3400 70 mm B&W	U	AS12-53-7763 thru 7947	This magazine contains photographs taken from the command module with the 500-mm lens. It includes craters Fra Mauro, Descartes, and Lalande; the solar eclipse; and targets of opportunity 18 and 32.*

*The targets of opportunity are identified in the "Apollo Targets of Opportunity Chart - Apollo 12," published October 23, 1969, by the Aeronautical Chart & Information Center. Copies of this chart are available, on a limited basis, from NSSDC.

APPENDIX B
S-158 Lunar Multispectral Camera (LMC) Experiment Coverage

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-246 70 mm Infrared B&W	AA	AS12-56A-8314 thru 8439	The areas covered simultaneously by these magazines in stereo strips include the regions of Theophilus, Descartes, Fra Mauro, Ansgarius, Kapteyn A and C, Lame, McClure, and Lalande and crater 286.*
Plus-X 3401 70 mm B&W	BB	AS12-56B-8298 thru 8439	
	CC	AS12-56C-8298 thru 8439	
	DD	AS12-56D-8298 thru 8439	

*Craters and basins are identified on the "Lunar Farside Chart" published in 1967 by the Aeronautical Chart & Information Center. The names on this chart were adopted from the International Astronomical Union (1935, 1961, and 1964).

APPENDIX C
16-mm Photographic Coverage

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-368 16 mm Color	A	1-1600 1780-4180	This magazine shows transposition and docking. These frames contain photographs of craters Colombo, Lame, and Kapteyn B, and the Montes Pyraeneus.
	B	1-5316	This magazine contains photographs of the LM prior to landing and also includes photos of craters Theophilus, Cyrillus, Cyrillus B, Kant, Descartes, Dollond, Andel, Ritchey, Hind, Halley, Albategnius, Klein, Muller, Ptolemaeus, Herschel, and Lalande A.
	C	1-2258* 2259-2373	The Basin II area is covered by this magazine. These frames contain sextant photography of the lunar landing site.
	D	2374-2554 2555-5459	These frames contain sextant photography of Lansberg A. These frames show the crater Ansgarius and the LM separation from the CSM.
	E	1-4726 1-1677	These frames show the docking of the LM; craters Ansgarius, Kapteyn B, Lame, Lohse, Crozier, Colombo, Magelhaens, Madler, and Theophilus; Mare Nectaris; the Montes Pyraeneus; and the LM jettison. These frames contain sextant photography at 12° south latitude, 41° east longitude to 4°3 south latitude, 22° west longitude. They include coverage of Daguerre, Theophilus, Kant, and Dollond.

*Craters and basins are identified on the "Lunar Farside Chart" published in 1967 by the Aeronautical Chart & Information Center. The names on this chart were adopted from the International Astronomical Union (1935, 1961, and 1964).

APPENDIX C (continued)

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
		1678-3272	These frames contain the sextant photography of the landmark tracking sites.
		3273-3277*	These frames include photographs of the transearth injection (TEI), Basin II, and craters 201, 197, 198, 199, 195, 192, 191, 189, 202, 204, 206, 207, 275, 277, 273, 270, and 276.
		3278-3643*	These frames include the TEI, eastern limb and farside terminator, Mare Crisium, and Basin II.
	F	1-3386	These frames contain sextant photography of the area from 3° south latitude, 123° east longitude to 3° north latitude, 52° west longitude.
		3387-3856	These frames show the solar eclipse by the earth.
S0-168 16 mm Color	G	1-5519**	These photographs show the reentry and parachute deployment.
	H	1-1103**	This is photography of the CSM interior and the astronauts' activities.

*Craters and basins are identified on the "Lunar Farside Chart" published in 1967 by the Aeronautical Chart & Information Center. The names on this chart were adopted from the International Astronomical Union (1935, 1961, and 1964).

**Photography of intravehicular activity and of the earth has been edited from the 16-mm film magazines and is not available through NSSDC. This photography can be obtained from NASA's Public Information Division. (See page 9 for address.)

APPENDIX C (continued)

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-164 16 mm B&W	I	1-2000	These frames contain oblique photographs of craters Herschel, Hind, Halley, Müller, and the north region of Ptolemaeus.
		2001-3431	Poor quality photography.
		3432-6000	This is an oblique sequence of Fra Mauro and Lalande.
	K	1-1164	These photographs, taken from the LM, show the CSM and craters Fra Mauro, Perry L and C, Lalande, Lalande A and C, Herschel, and Ptolemaeus.
		1165-5494	This section shows the LM descent and landing.
	L	1-1557	These frames contain views taken from the LM window of the lunar landing site and EVA activities.
		1558-4116	These frames are of the astronauts collecting samples during their traverse.
		4117-4814	These frames contain views of the ALSEP deployment.
	M	1-5466	These frames contain northwest views taken from the LM after landing and during EVA and the deployed ALSEP.

APPENDIX C (continued)

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
		5467-5576	These frames are views taken from the LM looking west.
	N	1-5539	This magazine contains views taken from the landed LM and panoramas of the antenna, the flag, and the deployed ALSEP.
	O	1-5518	These photos of the terrain were taken from the LM window.
	P	1-332	These frames were overexposed.
		333-1181*	These frames contain photographs of Lansberg N, earthrise, and Basin II.
		1182-3157	These frames contain photographs of the terminator, Maestlin R, and the CSM taken from the LM.
		3158-3458	Overexposed photography.

*Craters and basins are identified on the "Lunar Farside Chart" published in 1967 by the Aeronautical Chart & Information Center. The names of this chart were adopted from the International Astronomical Union (1935, 1961, and 1964).

APPENDIX D
35-mm Stereo Coverage

<u>Film Type and Size</u>	<u>Magazine</u>	<u>Frame Numbers</u>	<u>Remarks</u>
SO-368	FF	AS12-57-8441 thru 8455	This magazine contains close-up stereo photography of the lunar surface and of footprint impressions.